DONELAN CLEARY
WOOD & MASER, P.C.

EX PARTE OR LATE FILED

February 1, 1999

Magalie Roman Salas
Secretary
Federal Communications Commission
Washington, D.C. 20554

Re: CC Docket 94-102, Annual Report
Submitted as an ex parte communication per Section 1.1206

Dear Madame Secretary:

On behalf of CTIA, PCIA, three public safety organizations and the Wireless Consumer Alliance, here is the original and a single copy of the second annual report on implementation of wireless enhanced 9-1-1 services called for by the Report and Order of July 1996 in the referenced docket.

Please contact the undersigned or any of the other signatories if you have questions or wish additional information.

Sincerely,

James R. Hobson
Counsel for NENA

Cc: John Cimko, Wireless Telecommunications Bureau

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of the Commission's	)	CC Docket No. 94-102
To Ensure Compatibility with	)	RM-8143
Enhanced 911 Emergency Calling	)	
Systems	)	

REPORT OF CTIA, PCIA, APCO, NENA, NASNA, ALLIANCE

The Cellular Telecommunications Industry Association ("CTIA"), Personal Communications Industry Association ("PCIA"), Association of Public-Safety Communications Officials-International, Inc. ("APCO"), National Emergency Number Association ("NENA"), National Association of State Nine One One Administrators ("NASNA") and the Wireless Consumer Alliance ("Alliance") respectfully submit this second annual report on the status of certain issues regarding access to wireless E9-1-1. [1]

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[1] This report addresses only the wireless aspects of the docket. As indicated by the designator "RM-8143," the proceeding also includes wireline issues having to do with identifying and locating 9-1-1 callers from stations associated with PBXs and other types of Multiline Telephone System ("MLTS") equipment. These wireline issues were discussed in the 1994 original Notice in the docket, but have never been resolved. If a decision cannot be made on the present record, then the FCC should move to have the record augmented.

In its Report and Order of July, 1996, the Commission required the above-mentioned parties to report jointly to the Commission on the status of (1) the development of the technical and operational standards necessary to implement and enable widespread wireless access to emergency services, (2) the development of common channel signaling, and (3) the industry's progress in developing a "grade of service" standard for 911 service. This Report was developed by the Parties informally through the Wireless E9-1-1 Implementation Ad Hoc ("WEIAD") and addresses the issues delineated by the Commission. Additionally, this Report contains information on other 1998 actions and pending questions affecting the implementation of wireless E9-1-1.

I. Technical and operational standards

A. Work of standards bodies

The Telecommunications Industry Association ("TIA"), working jointly with the Alliance for Telecommunications Industry Solutions ("ATIS"), is developing an American National Standards Institute ("ANSI") standard that will provide recommendations for the implementation of Phase II location requirements. This standard will provide both Call Associated Signaling ("CAS") and Non-Call Associated Signaling ("NCAS") protocols

and procedures to convey the required location data from the wireless system to the 9-1-1 Selective Router ("SR"), which resides in the wireline network.[2] The standard also provides the capability to support network-based as well as mobile-based or mobile-assisted location applications. It is expected that this standard will be balloted in the April/May 1999 timeframe.

The ISDN Joint Study Group of the National Emergency Number Association ("NENA") Network and CPE Technical Committees is developing ISDN protocols and procedures for both Basic Rate Interface ("BRI") and Primary Rate Interface ("PRI"), to convey the location data from the SR to the PSAP CPE. This work is being coordinated between TIA/ATIS and NENA to assure consistency from the wireless system through to the PSAP CPE. The BRI document is in the approval process.

B. Strongest signal

In the past year, the WEIAD continued to address the "Strongest Signal" proposal. At the January, 1998, WEIAD 3 meeting, consensus was reached and a report sent to the FCC recommending that this issue be submitted to the Telecommunications Industry Association's ("TIA")

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2 In Call Associated Signaling, ANI and ALI data is associated with the voice path; in NCAS, some of the data is routed separately before reaching the PSAP.

standards group for a technical review by appropriate engineering committees. The Alliance officially informed the FCC that they did not support this WEIAD recommendation and did not consider it a "standards" issue but strictly a "policy" issue. The WEIAD also encouraged the wireless industry to educate users how to program their analog phones for preferred over alternate service providers (A over B, or B over A). In addition, for newly provisioned analog only phones (after some future date certain), CTIA proposed that wireless carriers program analog phones to use A over B, or B over A with the proviso that users can elect to stay only on their preferred carrier.[3] The WEIAD accepted these proposals. The Alliance specifically stated that such proposals were not accepted as a substitute for Strongest Signal.

During the WEIAD-6 meeting of November, 1998, the Alliance introduced a modified approach to Strongest Signal referred to as "Signal

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[3] CTIA notes that it submitted a standards requirements document titled *911 Call Completion* to TIA Committee TR45 at its June, 1998, meeting. By means of this document, CTIA asked the industry standards group to review all wireless industry air-interface and network standards to determine if a process exists or should be developed that increases the likelihood of getting a wireless "9-1-1" call through to a public safety answering point. On September 24, 1998, TR45 responded to CTIA and recommended an "Automatic A/B Roaming" approach be adopted. CTIA has submitted this recommendation to the Commission, endorsed the TIA proposal, and urged the Commission to adopt it. See October 7, 1998 CTIA Comments. Subsequently, at the November, 1998, WEIAD-6 meeting, Motorola submitted an enhancement to the "Automatic A/B Roaming" proposal known as "intelligent retry." Motorola formally submitted the "intelligent retry" proposal to TIA Committee TR45 at its January, 1999, meeting.

Threshold." The WEIAD has agreed that consensus cannot be reached on this issue and seeks FCC deliberation.

C. Grade of Service

In the 1998 report, we stated that "wire telephone companies leave to the wireless carrier the determination and ordering of trunk capacity to connect the mobile switch to the public switched telephone network." This is true in general, but incorrect with respect to 9-1-1 trunking, where capacity most often is dictated by the 9-1-1 authority.

NENA established a Congestion Control Study Group at its 1998 Telecommunications Development Conference in February. ("TDC"). The issue was discussed further at a meeting of the NENA Network Technical Committee in June. The search began for someone to chair the effort. Consensus was reached that a member of the wireless industry was needed to chair the Study Group. Just recently, Jim McGarrah of BellSouth Cellular agreed to take the job.

The first official meeting will take place at this year's TDC in March. NENA will probably dedicate all or part of a session to it. The Study Group's mission is twofold: One job is to document the congestion control method currently implemented in the wireline network. The other is to develop a corresponding method for wireless interconnection. The two

methods will be somewhat different, based on the technological differences between the services, but will provide an equivalent level of service.

The Study Group will only address trunk groups from wireline end offices to the 9-1-1 selective routing tandem, and trunk groups from mobile switching centers ("MSCs") to the 9-1-1 selective routing tandem. We will probably not address the "line side" of either. NENA hopes that the Study Group will have a preliminary document in time for the Fall Technical Conference in October.

The question of grade of service on the "radio" side of the wireless network is disputed within the WEIAD forum where the parties have discussed it. To their previous belief that competitive forces within the wireless services marketplace will assure against degradation of grade of service, some industry representatives have added the view that wireless grade of service may not be measurable in the terms applied to the wireline network.[4] Public safety organizations continue to believe that comparability

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[4] CTIA believes that both wireline and wireless 911 "trunking" are comparable and should be engineered to the same grade of service, but because of the dynamic nature of mobile users, traditional wireline grade of service measurements are inapposite for the "line" side, *i.e.,* the radio interface, of wireless networks. In addition, as long as local zoning restrictions frustrate CMRS carriers' ability to site needed facilities, *i.e.,* within Rock Creek Parkway, not only is this inappropriate regulatory measurement, it also will be impossible to apply, since it is impossible to determine how many call attempts are made and fail to reach a base station when there are no base stations within range of the mobile unit.

is possible and that wireless grade of service for 9-1-1 can and should be regulated. The Alliance has conducted rudimentary tests suggesting that the grade of service in some wireless networks is far below that expected from wireline service providers. These differing views may lead one or more of the parties to consider petitioning the Commission to take action on the issue.

D. Callback.

In last year's report, the public safety organizations and the wireless industry acknowledged (Recommendations, Appendix B) that efforts to solve the problems of callback to certain uninitialized or otherwise hard-to-reach phones (e.g. lapsed subscription, no roaming agreement) should be proportional to the frequency of such problems. The parties undertook long-term efforts to ascertain how many wireless 9-1-1 calls occur in situations precluding callback. Those efforts continue, but the question is not easily answered.

The technical impediments that forced the policy choice of forwarding all calls – in preference to sending PSAPs only validated calls – have not yet been overcome.[5] Because PSAPs continue to place a high priority on the

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[5] 12 FCC Rcd 22665, 22680-82 (1997)

ability to call back a 9-1-1 caller, the public safety signatories remain concerned about these impediments. They also need ways of identifying prank or harassing calls, so that wasteful and dangerous "wild goose chases" by responders can be avoided. In this connection, the PSAPs look to ongoing work by standards bodies that may, in the future, permit the transmission of an "emergency service routing key" – a short string of digits, not itself a callback number, that would survive long enough to allow the PSAP to seek unique information about the calling handset. Such information, if it did not identify the caller, might at least allow responders to recognize a chronic source of harassing calls to 9-1-1.

II. Other Pending Issues

A. Phase II Location.

1. Accuracy

In the Further Notice issued with its 1996 First Report and Order on wireless E9-1-1 rules, the FCC proposed to adopt quickly a standard of improved accuracy to succeed the Phase II 125-meter RMS requirement that becomes effective in October of 2001. It suggested 40 feet as the new standard, measured not only in the x and y coordinates of longitude and latitude but also along a z-axis of vertical distance above ground. The

Further Notice proposed that this standard be met "for 90 percent of the 911 calls processed."[6] The proposal remains pending.

When the accuracy requirements were under consideration two or three years ago, the industry assumed they would be met by "network-based" solutions overlaid on existing cellular and PCS radio facilities. 11 FCC Rcd at 18732. Those solutions relied primarily on the differential angles and times by which a signal from a mobile handset reached two or more base station antennas in the terrestrial system. While portable transceivers could be equipped to communicate with satellites in the Global Positioning System ("GPS") created by the U.S. government, they could only operate reliably if able to "see" three or more satellites. Thus, GPS technology was disfavored for calls originating in buildings or in the shadow of man-made or natural obstructions. Moreover, GPS technology was considered expensive and incapable of ubiquitous use, when compared with network-based solutions requiring no handset upgrades and relying on cellular and PCS infrastructures that were relatively common across the country.

More recently, proponents of GPS radiolocation have claimed that improvements in satellite signal processing for blocked or shadowed

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6 11 FCC Rcd 18676, 18743-44 (1996)

environments, as well as reductions in handset component costs, warrant relief from the current rule at 47 C.F.R.§20.18(e). They note that because the Commission's rule is applied to "all 911 calls," it does not accommodate gradual changeover to GPS-equipped handsets in a given area, or account for entry into GPS systems by "roamers" from an area where radiolocation is wholly network-based and whose handsets are not GPS-equipped.[7]

Recognizing that the effect of Section 20.18(e) might not be technologically or competitively neutral for some technologies used to provide ALI, the FCC recently stated that it will consider waivers of the regulation for wireless carriers. The FCC noted that carriers seeking waiver of ALI requirements must demonstrate their commitment to, and plans for achieving, the goals of Section 20.18(e). According to the Commission, a commitment by a carrier to provide a significantly higher level of accuracy or accelerated introduction of ALI capabilities could help justify a phase-in of ALI over time, through upgrading or replacing handsets. Two other factors that carriers could add in their waiver request concern the costs

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[7] A roamer with a GPS-equipped handset is presumed to be able to take advantage of network-based radiolocation outside his home area, so long as he has an air interface compatible with the system into which he roams.

associated with handset upgrades and the difficulty of using a GPS system by non-GPS handset roamers. [8]

2. Reliability

On November 25, 1998, WEIAD filed with the FCC an ex parte letter urging a change in the Root Mean Square ("RMS") measure of reliability in the Phase II wireless caller location standard. The letter is included as Attachment 1 to this report. In recommending the revision of Section 20.18(e), WEIAD noted that the RMS statistical methodology requires accounting for the distance by which every call misses the 125-meter target. Because some calls can be expected to yield no latitude-longitude data at all, the ALI determination must default to the Phase I standard based on the location of the cell site or sector first receiving the wireless 9-1-1 call. Since many cell sites may have radii of a mile or more, plugging these large differentials between actual and radio-determined location into the RMS formula virtually guarantees failure of the test.

The WEIAD letter therefore suggested the use of Circular Error Probability ("CEP") in place of RMS. In the CEP method, the requirement for location within the 125-meter-radius target would remain at the 67% reliability roughly represented by the RMS measurement, but the distance by

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[8] Public Notice, DA 98-2631, December 24, 1998.

which the off-target calls missed the mark would no longer be calculated. Thus, the skewing effect of the default Phase I data would be eliminated. WEIAD observed that performance under the CEP approach would be easier for public safety authorities to evaluate and enforce than would be the case under the RMS method.

B. Phase I implementation

1. Slow pace

NENA has been surveying PSAPs to see how many have requested Phase I ANI and ALI under Sections 20.18(d) and (f) of the FCC's rules. It asked whether Phase I has been implemented and if not, why not, and what year implementation is expected. As of September 30, 1998, returns had been received from about 600 of the 3700 questionnaires sent out.[9] Only one percent answered yes to Phase I implementation. Of the negative responses, lack of a funding mechanism was mentioned in about half the returns and "PSAP equipment not ready" in almost a quarter of the answers.

Different snapshots of implementation activity are presented by data assembled by two wireless E9-1-1 vendors, SCC Communications

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[9] Apart from other factors that tend to keep low the rate of direct-mail survey returns, it appears that some of the recipient PSAPs may have considered themselves lacking in authority to respond under state or local law or administrative practice.

Corporation and XyPoint.[10] SCC reports that it has received, from the wireless carriers it serves, some 2300 PSAP requests made to those carriers. Included in that number are requests made by the same PSAP to multiple carriers serving the PSAP's jurisdiction. Of these requests, however, only 560 are classified by SCC as in "active deployment," and in only 27 of the cases has Phase I service actually been implemented.

According to the XyPoint data from five wireless carriers it serves, more than 30 PSAPs were placed in "production" toward implementation in 1998 and one thus far in January 1999. Again, these totals reflect duplications where two or more carriers serve the same PSAP.

2. Obstacles, pending questions

A number of obstacles have been identified that are impeding the implementation of wireless E9-1-1 service.[11] They can be grouped into three broad categories of issues: (1) Technology; (2) Operational, and (3) Policy.

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[10] The WEIAD parties are not in a position to verify the accuracy of the data and disclaim any endorsement of it. Nevertheless, we appreciate the contributions by the two vendor companies and offer portions of their information as possibly useful indicators of levels of implementation activity that do not depend on the verifiable precision of particular numbers.

[11] Beyond the scope of this Report is CTIA's request for the Commission to adopt "9-1-1" as the uniform national emergency number, and its request for the Commission to insure that zoning restrictions do not prevent emergency calls from being completed from wireless phones.

Many of these issues fall into two or more categories, and most are pending before the Commission. They are noted here without further commentary.

Cellular and PCS carriers have deployed four air interface standards: analog "AMPS" (for cellular only), TDMA (for both cellular and PCS), CDMA (for both cellular and PCS), and GSM (for PCS only). These different air interface standards give rise to interoperability (*i.e.*, roaming) issues. For example, a carrier that has deployed AMPS and CDMA in a market needs a location system that can locate phones based on both technologies. The carrier also needs roaming partners who are using compatible location technologies to provide location service to roamer customers. Moreover, among the various GPS-based handset approaches, various GPS solutions are being developed. Some vendors require a network-based (network assisted) element in addition to a GPS-enabled handset. As of the date of this report, it is not known which GPS-based technologies would be interoperable on networks deploying a different GPS solution.

As noted in Section I, above, important work remains to complete the technical standards required for Phase II implementation. This work is going forward and the contemplated standard is intended to support multiple implementation techniques (including both CAS and NCAS). The

availability of multiple implementation techniques provide PSAPs and CMRS carriers with a series of choices, including the need to select CAS, NCAS, or a hybrid interconnection to the PSAP. Absent cooperation and coordination among the PSAP, the serving LEC, and the wireless carrier, the availability of multiple options can become an implementation issue. There also are multiple location technologies. A major impediment to the implementation of wireless E9-1-1 can be differences between the PSAP and wireless carrier concerning selection of the location technology. The question of who selects the technology in the event of an impasse is pending before the Commission.

Cost recovery issues also have been placed before the Commission. Carriers and PSAPs alike have questions concerning what constitutes an adequate cost recovery mechanism. Moreover, CMRS carriers face implementation issues (such as accurate billing of 9-1-1 surcharges) when forced to accommodate multiple jurisdictional authorities with different cost recovery mechanisms.

Despite good faith efforts by all the parties involved, the need for PSAPs, LECs and CMRS carriers to work cooperatively to implement wireless E9-1-1 remains an implementation issue of critical importance. To date, the Commission has imposed no responsibilities on Local Exchange

Carriers ("LECs") to provide the capabilities wireless carriers and PSAPs need to implement Phase I and Phase II E9-1-1 services.

Another implementation issue surrounds the rights to the ALI data base required to provide a wireless E9-1-1 service. In the wireline environment, the LEC controls the ALI information associated with its customers. Wireless carriers want to control the ALI data bases associated with their customers. The issue of data base control impacts connectivity and CAS vs. NCAS selection decisions.

Finally, as noted below, the FCC's Wireless Bureau recently addressed the question of carriers' ability to limit their liability as a prerequisite for providing E9-1-1 service. Internal appeals of that staff decision mean that this important issue remains unsettled. The continuing uncertainty is an obstacle to implementation.

3. California 9-1-1 declaratory ruling

On December 18, 1998, the FCC issued a staff order declaring that wireless carriers are obliged to implement Phase I "without regard to whether the State affords the carrier some degree of legal immunity from liability."[12] Responding to questions from the California 9-1-1 Program Manager, the order also found it "at least premature to conclude that

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[12] Declaratory Ruling (CC Docket 94-102), DA 98-2572, December 18, 1999, ¶9.

reimbursement of liability insurance should be considered a requirement that the State must meet to satisfy the general cost recovery condition." (¶16) Finally, the order affirmed that state and local authorities control "selective routing" based on wireless ALI, but declined to enter into questions surrounding a California state law requiring that all wireless 9-1-1 calls be sent to the California Highway Patrol. On January 19, 1999, U.S. Cellular filed an Application for Review and Omnipoint a Petition for Reconsideration of the Wireless Bureau order.

4. TTY incompatibility with digital wireless service.

(a) WIRELESS E9-1-1 TTY FORUM

Since September 1997, the Wireless E9-1-1/TTY Forum ("TTY Forum") has convened on ten separate occasions in order to continue collaborative efforts to provide viable solutions for TTY access to 9-1-1 over digital wireless systems.[13] The TTY Forum has made significant progress over the past year. Specifically, the TTY Forum developed a uniform test methodology to compare character error rates across the various digital wireless technologies. Several members of the TTY Forum have conducted

[13] The TTY Forum Meetings were held on the following dates: September 17-19, 1997; December 11-12, 1997; February 11-12, 1998; April 1-2, 1998; May 20-21, 1998; July 21-22, 1998; September 8-9, 1998; October 7-8, 1998; November 4-5, 1998, and January 26, 1999. A subsequent meeting is scheduled for May 25, 1999, in the Washington, DC or Baltimore area.

tests based on this test methodology to determine: 1) whether digital wireless technologies and Baudot TTY devices can achieve a character error rate ("CER") comparable to a character error rate for analog cellular and Baudot TTY devices, *i.e.,* less than 1%; 2) whether modifications to digital wireless handsets and TTY devices are necessary to achieve a character error rate comparable to CER for analog cellular; and 3) whether standardization of the audio input and output levels in the digital wireless handset and the Baudot TTY can provide optimal results for TTY users. The test results continue to show a 2% to 4% CER for TDMA, 0.78% to 5.6% for GSM, 12% to 18% for CDMA, and 0.64% to 4.18% for iDEN depending on a number of variables.

The most recent TTY Forum Meeting (TTY Forum 10) was held on January 26, 1999, in Washington, D.C. The highlight of the Forum was Lucent Technologies' "No Gain Solution" which appears to be a very promising voice-based solution. While this solution was built to solve for CDMA, Lucent claims it is applicable to any air interface technology that uses CLEP VOCODER technology.[14] In May 1998, Lucent provided the

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[14] The "No Gain Solution" requires a small software modification to existing CLEP VOCODERS in the handset and BSC. See Appendix A for a detailed explanation of this solution. At TTY Forum-10, a representative from Lucent indicated that Lucent would make the "code" available for testing purposes only.

TTY Forum with a major breakthrough with respect to identifying one source of the problem of passing the Baudot signal over CDMA air interface. Specifically, the problem was not the VOCODER as engineers had initially suspected, rather Lucent's test results indicated that the problem was more closely related to the CDMA frame error rate that is inherent in CDMA technology. By November 1998, Lucent developed the "receiver/repeater" approach which produced a 2.5% CER. Not satisfied with this CER, Lucent continued its research and developed the "No Gain Solution." Lucent estimated that the software will be available internally by June 1999, with product available by 4Q 1999, which is approximately 18 months from identifying a major source of the problem.

The TTY Forum also has developed a technical information document ("TID") and a Standards Requirement Document ("SRD") for various voice based (direct electrical connection) and data based (circuit switched data) solutions. The TID was submitted to TIA's TR45 standards-setting body in January 1999, and the SRD will be submitted at the next TR45 meeting. The Wireless TTY Forum has also reviewed several proposals for data solutions. While these solutions are very promising, they require modifications to the network infrastructure. It appears that several proposed data solutions require the development of software, input from Inter-Working Function

manufacturers, and the development of standards. The Forum has taken significant steps to encourage IWF manufacturers to develop the appropriate software for those carriers that chose to implement such a solution.

Finally, the TTY Forum has finalized a workplan that provides scheduled milestones for the development and implementation of data solutions as well as voice based solutions over the next 12 to 18 months.

(b) WAIVER OF THE FCC'S E9-1-1/TTY COMPATIBILITY RULE

On December 30, 1998, the Commission adopted an Order *("TTY Waiver Order")* granting a temporary waiver of its E9-1-1/TTY compatibility rule for those CMRS carriers that filed waiver requests as of December 30, 1998. Having received over 100 petitions for waiver of the compatibility rule, the FCC is currently reviewing and evaluating each petition. The FCC has not indicated when they will complete their evaluation.

In the *TTY Waiver Order*, the Commission acknowledged that a number of the petitioners filed detailed analyses of the problems and difficulties associated with achieving TTY compatibility with digital wireless systems, and they discussed various solutions that could be explored to achieve such compatibility. The Commission concluded that additional time is necessary to complete a thorough and careful review,

evaluation and disposition of the pending petitions. Accordingly, it granted a temporary waiver of its E9-1-1/TTY compatibility rule to the petitioners until the Commission's subsequent disposition of the individual petitions for waiver. The *TTY Waiver Order* also stated that the waivers granted might be extended subject to any conditions and requirements that the Commission deems appropriate. The *TTY Waiver Order* is very clear that any CMRS carrier who is subject to the E9-1-1/TTY compatibility requirement and has not filed a petition for waiver of the rule must comply with the rule as of January 1, 1999.[15]

C. Phase II developments

In addition to the discussion at II.A. above, the parties wish to note the increasing pace and depth of discussion about potential commercial applications for radiolocation that might use platforms constructed for E9-1-1 purposes. From the perspective of public safety organizations, this bears

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[15] On January 8, 1999, the Commission granted a temporary waiver of its E9-1-1/TTY compatibility rule to Price Communications Wireless, Inc. which filed a petition for waiver of the rule on December 31, 1998. Although the petition was filed prior to the January 1, 1999, effective date of the rule, the petition was filed after the adoption date of the *TTY Waiver Order*. The temporary waiver is subject to the same terms and conditions set forth in the *TTY Waiver Order* adopted by the FCC on December 30, 1998. On January 15, 1999, the FCC released an Erratum correcting the Appendix of the *TTY Waiver Order*. Five additional petitions filed prior to December 30, 1998 were discovered by FCC staff after release of the *TTY Waiver Order*. On January 20, 1999, the FCC released another Erratum correcting the Appendix again. Two parties who did not file waiver petitions had been inadvertently included in the Appendix.

on the question of funding for radiolocation systems because these organizations are disinclined to offer non-reimbursable subsidies for the construction of facilities that will have revenue-generating applications beyond wireless E9-1-1. Some wireless carriers resist the implication that Phase II radiolocation should be denied public funding because they believe that most commercial applications to date require only Phase I levels of precision and that public safety remains, for now, the sole viable application for Phase II. Some radiolocation vendors respond, however, that no Phase I commercial applications have been deployed at this time. In fact, this absence to date of CMRS-based commercial radiolocation applications makes more detailed discussion speculative.

Respectfully submitted,

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February 1, 1999

ATTACHMENT 1

DONELAN CLEARY WOOD & MASER, P.C.

November 25, 1998

Magalie Roman Salas
Secretary
Federal Communications Commission
Washington, D.C. 20554

Re: CC Docket 94-102, ex parte communication per 47 C.F.R.§1.1206

Dear Madame Secretary:

On behalf of the Wireless E9-1-1 Implementation Ad Hoc (WEIAD), a group of wireless carriers, vendors, public safety communicators and consumer interests, we suggest the following clarification of the "Phase II" radiolocation standard found at Section 20.18(e) of the Rules:

> Phase II location will be attempted on all 911 calls routed toward a Public Safety Answering Point ("PSAP") and will be accurate to within 125 meters in 67% of these cases.

WEIAD's reasons for recommending the clarification are set forth below.

Background

Section 20.18(e) was adopted in mid-1996. At the time, it read:

> As of October 1, 2001, licensees subject to this section must provide to the designated Public Service [sic] Answering Point the location of a 911 call by longitude and latitude within a radius of 125 meters using root mean square techniques. 47 C.F.R.§20.18(e) (1997)

In adopting this language, the Commission said:

> Our initial proposal did not discuss a reliability factor for [Automatic Location Information] ALI. Based on the comments and evidence in the record from the actual

> trials of ALI technologies, we believe that the Agreement's proposed RMS probability standard for location accuracy is reasonable.[1]

In further discussion, the Commission spoke of meeting the accuracy target in "67 percent of all cases," an approximation of root mean square statistical methodology in Gaussian or near-Gaussian distributions. The 1996 Order went on to say:

> For purposes of complying with this requirement, covered carrier shall attempt to invoke the equipment and facilities they have deployed to determine mobile unit location in each case in which a 911 call transits their system. For purposes of applying the RMS methodology, the level of accuracy achieved by a carrier shall be calculated based on all 911 calls originated in a service area in which the carrier is required to supply Automatic Location Identification to PSAPs. 11 FCC Rcd at 18712.

On reconsideration of the 1996 Order, the Commission changed slightly the text of Section 20.18(e):

> As of October 1, 2001, licensees subject to this section must provide to the designated Public ~~Service [sic]~~ Safety Answering Point the location of a all 911 calls by longitude and latitude ~~within a radius of~~ such that the accuracy for all calls is 125 meters or less using a root mean square ~~techniques~~ methodology.[2]

The Reconsideration Order explained these changes in the context of responding to commenters asking whether locating 67 percent of mobile units 100 percent of the time, or 80% of the units 90% of the time, would satisfy the standard. The Commission sought to clarify that

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1 *Enhanced 911 Emergency Calling Systems,* 11 FCC Rcd 18676, 18711. ("1996 Order") "Agreement" refers to a partial consensus on wireless E9-1-1 issues reached by three public safety communications organizations and CTIA, submitted for the docket record in February of 1996. The Commission noted that the consensus paper referred to statistical theory on Gaussian curves and to tests by location vendors suggesting that "125 meters RMS" would equate to a 125-meter accuracy two-thirds to three-quarters of the time. *Id.* at n.132.

2 Memorandum Opinion and Order, 12 FCC Rcd 22665, 22745 (1997) ("Reconsideration Order"), deletions stricken through, additions underlined.

> the RMS methodology should be applied to reach this level of accuracy in identifying the location of each 911 call. To comply with the rules, therefore, we stated that a carrier must deploy the ALI technology in its service area and determine mobile unit location in each case in which a 911 call transits its system. (12 FCC Rcd at 22726, emphasis in original)

The Commission said that 125 meters RMS "would represent approximately a 67 percent to 75 percent probability that the reported location would be within a 125 meter radius of the caller's actual location." *Id.*

The Ericsson ex parte Communications

On March 20, 1998, Ericsson presented to the Commission its belief that the Phase II accuracy requirement -- although nominally based on RMS methodology -- had been widely interpreted by carriers and vendors to mean 67 percent "circular error probability," or CEP. The difference in the two concepts, Ericsson explained, is that the second method looks only to the percentage of all calls that can be located within the roughly circular area of 125 meters radius, while the first (RMS) takes into account the distances outside the circle of those calls that fail the test.

Because a certain percentage of calls that make voice connections will be unable to supply latitude and longitude, Ericsson continued, the best location determination available will be the Phase I default datum, namely the cell site or sector of the base station first receiving the 9-1-1 call. Since these cells or sectors may have radii of several hundred meters, well beyond the 125-meter target, the substitution of Phase I default distances in the RMS formula is likely to result in failure to meet the test. This could happen if there were a few instances of default to especially large cells, or more cases of default to smaller cells whose radii nevertheless exceeded 125 meters. Ericsson therefore urged the Commission "to define the 125-meter accuracy requirement as the maximum 67% CEP radius." (March 20th letter at 10)

In a further ex parte communication of April 6, 1998, Ericsson proposed a second alternative, "an accuracy of 125 meters RMS error in 90% of the cases." Ericsson estimated that by allowing the discarding of 10 percent of the calls, the worst of the "outlier" failures -- distance errors far exceeding 125 meters -- could be eliminated and the 125-meter accuracy standard could be met.

Ericsson presented both alternatives to the fourth meeting of WEIAD in May of 1998. After considering the matter on two separate occasions, WEIAD voted to adopt the first alternative, expressed as:

> Phase II location will be attempted on all 911 calls routed toward a Public Safety Answering Point ("PSAP") and will be accurate to within 125 meters in 67% of these cases.

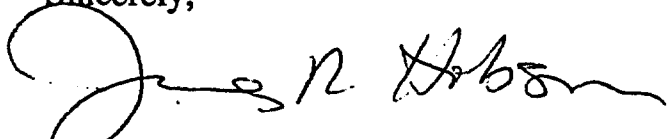
WEIAD made the choice as a preferred way "to translate RMS into non-technical terms" that would provide a "well-defined and measurable target for the industry." The criterion of ease of measurement also took into account public safety organizations' need to evaluate carrier and vendor compliance. As Ericsson explained in its March 20th letter:

> With the 67% criterion all a dispatched unit would have to do is to report if the indicated position was roughly within 125 meters or not. . . . In order to validate an RMS criterion, each dispatched unit would have to figure out exactly where the origin of the given position was and then exactly measure the distance to the actual position.

Conclusion

For reasons discussed above, WEIAD asks that the Phase II accuracy and reliability target at Section 20.18(e) of the Rules be clarified as "accurate to within 125 meters in 67%" of all calls "routed toward a Public Safety Answering Point." Although WEIAD does not favor retention of the RMS criterion, should the Commission continue to prefer its use, we strongly recommend that some allowance be made -- such as the 10% factor estimated by Ericsson -- for the cases where location determinations will far exceed the 125-meter target.

Sincerely,



James R. Hobson
Counsel for the National Emergency Number Association,
acting for WEIAD

cc: Chief, Wireless Telecommunications Bureau, FCC

APPENDIX A

TR45.5

TITLE:

Simulation of a Robust In-Band Transmission System for TTY/TDD Signals Using an Inter-Operable Modification of the IS-127 Standard Speech Coder

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ABSTRACT:

A robust system for transmitting 45.45 BPS Baudot-Encoded TTY/TDD signals using an inter-operable modification of the IS-127 EVRC speech coder is presented. The methods used combine an enhanced version of the TTY/TDD Receiver/Repeater concept originally presented by R. Haimi-Cohen of Phillips Consumer Communications, some minor modifications of the EVRC algorithms, and a new approach that embeds redundant TTY/TDD information in the EVRC data packets without affecting inter-operability with unmodified EVRC implementations. Results in terms of TTY character error rate (CER) are presented for clean channel conditions and for a 2% FER channel.

RECOMMENDATION:

Informational.

INTRODUCTION:

In the November, 1998 task group meeting, we had presented a contribution demonstrating the performance of a simulation of the PCC proposed TTY/TDD Receiver/Repeater algorithm for robustly transmitting Baudot TTY signals in-band. Those simulation results made use of idealized models of a TTY demodulator and of the CDMA channel. That contribution showed that, in a 2% FER channel, the character error rate (CER) could be reduced from roughly 17% to below 1%. Since that time, we have conducted a number of additional experiments using more realistic rather than idealized simulations for the vocoders, channel and demodulator. The CERs obtained in these new experiments was considerably higher than that obtained in the idealized simulations. For example, for the EVRC, the CER obtained in a 2% FER channel was about 2.5% rather than the less than 1% quoted in our November contribution. On further examination, it was discovered that the best performance obtainable with the EVRC in clear channel conditions (0% FER) was about 1%. Similar results were obtained for the CDMA-13K vocoder. While the 2.5% CER obtained using the receiver/repeater might be adequate to meet the federal mandate, we discovered an improved method that leverages the same processing required by the receiver/repeater and permits us to achieve significantly better performance in both clear and impaired channel conditions.

A new interoperable solution (the LT-TTY solution) is proposed to yield essentially a 0% CER for clean channel as well as 2% FER channel conditions. The new solution involves some modifications to the EVRC encoder[1] as well as the decoder, but is much more robust in bridging multiple frame erasures and is expected to give good performance even in channels much worse than 2% FER. The LT-TTY solution is completely interoperable with unmodified EVRC systems, and it is recognized that a modified decoder might sometimes have to operate in an environment where the encoder has not been modified. In order to improve performance in these cases, the LT-TTY solution also incorporates the receiver/repeater. In all other cases, the receiver/repeater is present in the decoder but does not operate. Complexity is very low and is approximately the same as that required to implement the receiver/repeater, so the incremental compexity incurred in implementing the LT-TTY solution is minimal. This contribution briefly outlines the results of our experiments with the EVRC and 13K vocoders, describes the new algorithm and the way it is combined with the receiver/repeater and presents results on both clear channel and 2% FER channel conditions for all encoder/decoder combinations.

It is our intention to provide source code for the modified EVRC encoder as well as some useful utilities. The simulation is in the last stages of testing, and should be available in approximately two weeks. Interested parties should contact either of the authors of this contribution to obtain the software and documentation.

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[1] While the new solution was implemented using the EVRC, the principles generalize equally well to all of the currently standardized speech coders for wireless applications.

BACKGROUND

A number of sources (including Lucent) have presented CER results for TTY/TDD signals passed through various speech coders under different channel conditions. The industry consensus was that, in clear channel conditions, the speech coder does not constitute a significant impairment to Baudot signals, and that the CER in impaired channel conditions was between 8 and 9 times the FER. This result was consistent with intuition since a Baudot character occupies between 8 and 9 CDMA frames, and if any one of them were to be lost the character would also be lost. Our experiments with both the EVRC and the QCELP-13K vocoders verified that it is possible to obtain 0% CER for a clear channel using the QCELP-13K vocoder, but that the best performance in a clear channel using the EVRC would be slightly more than 1% CER. Further study yielded the understanding that the EVRC's simplified long-term predictor causes as much as a 5 msec. jitter in Baudot pulse duration, which in turn leads to the observed degradation in clear channel CER performance. This supposition was verified by the fact that 0% CER was obtained in a clear channel once the EVRC's long-term predictor was disabled. The other effect noted was that, in the frame following an erasure, there was a lag of about 10 msec before the decoder converged to the correct value if a bit transition had occurred during the erased frame. The duration of this re-convergence interval was closer to 20 msec for the QCELP-13K vocoder, accounting for its significantly worse CER performance in channel impairments.

The original receiver/repeater solution was proposed as a passive receiver-only modification. However, because of the timing jitter introduced by the EVRC's long-term predictor, the best performance obtainable using the original receiver/repeater proposal is limited to about 1% CER in clear channel conditions and about 2.5% CER in a 2% FER channel. On the other hand, if the field of possible solutions is opened up to include low-complexity completely transparent (interoperable) modifications to the encoder as well as the decoder, considerably better results are possible. Particularly, since part of the EVRC's difficulty in transmitting TTY/TDD signals arises from the fact that its long-term predictor is ill-suited to modeling the Baudot waveform, it is apparent that the bits used to convey the long-term prediction information can be put to better use provided that Baudot waveform-containing frames can be uniquely identified to a modified decoder. The LT-TTY solution makes use of the delay bits to convey Baudot characters in frames that contain ONLY Baudot waveforms. Since the adaptive codebook gain is set to zero in these, an un-modified EVRC decoder simply ignores the delay information, rendering this type of approach transparently interoperable with an unmodified EVRC decoder. Moreover, since the adaptive codebook is disabled for Baudot frames, the performance of an unmodified decoder is better when used with a LT-TTY modified encoder than when used with an unmodified EVRC encoder.

HIGH-LEVEL DESCRIPTION OF THE NEW ALGORITHM

The following modifications are made to the EVRC encoder: A Baudot detector is used to distinguish input frames that contain ONLY Baudot waveforms. If Baudot is detected, noise suppression is turned off, the rate decision algorithm (RDA) is forced to encode the packet at Rate 1, the adaptive codebook gain is forced to zero prior to matching, and a "Waiting-for-Baudot" code is inserted into the bits normally used for the pitch lag in the EVRC encoded data packet. The encoder simultaneously encodes the Baudot signal without an adaptive codebook contribution, permitting an unmodified decoder to operate on the packet stream. As long as Baudot is detected, the algorithm demodulates the signal and begins buffering decoded character information until an entire character is decoded, while continuing to transmit packets with zero adaptive codebook gain and the "Waiting-for-Baudot" code inserted into the delay bits. Once an entire character has been decoded from the audio input, the character is then encoded into the pitch delay bits along with a sequence number to uniquely identify the particular character and its instance. The character is then transmitted in the same way in each frame until either the next character is decoded or 9 frames have elapsed. In this way, the decoder has between 8 and 9 opportunities to receive the character and regenerate it, permitting robust detection in channels considerably worse than 2% FER.

On the decoder side, a Baudot detector is used to detect frames containing ONLY Baudot waveforms. If Baudot is detected, the algorithm begins demodulating the Baudot signal and buffering the demodulated output. Simultaneously, it checks for the presence of the combination of zero adaptive codebook gain and the "Waiting-for-Baudot" code in the pitch lag bits to determine whether or not the signal originated from a modified EVRC encoder. If the adaptive codebook gain is not zero but Baudot waveforms are detected, it is assumed that the signal originated with an unmodified encoder and the algorithm operates as a character-based implementation of the receiver/repeater. If the adaptive codebook gain is zero and the "Waiting-for-Baudot" code is present for a requisite number of frames, it is assumed that the signal originated with a modified EVRC encoder and waits to receive the first character and sequence number in the pitch lag bits. In both cases, audio output is muted pending the receipt/demodulation of an entire character, and once demodulated, the character is regenerated at the decoder by an ideal TTY/TDD modulator. Other changes in the decoder resulting from a Baudot detection are that the frame erasure handling and postfilter are disabled for Baudot frames, and the decoder is reinitialized on the first good frame following an erasure, provided the last good frame was a Baudot frame. This last modification reduces the reconvergence interval for the decoder after an erasure and significantly improves the performance of the receiver/repeater.

RESULTS AND DISCUSSION

Six scenarios have been tested:

1. **Unmodified encoder (noise suppression on) - unmodified decoder.** This is the baseline case.

2. **Unmodified encoder (noise suppression off, RDA forced to full-rate) - unmodified decoder.** This case is included because the ability to externally control whether or not noise suppression is turned on and to force the RDA to a particular rate is required by the IS-127 specification, and it is known that: (a) Noise suppression may be turned off with very little effect on speech in the forward link (in fact, it may actually improve tandem performance), and (b) some terminals that implement a special connector for TTY (but no other modifications) may be able to sense the presence of something connected to the TTY connector and transmit these commands to the EVRC encoder without modifying their vocoder firmware.
3. **Unmodified encoder (noise suppression on) - modified decoder.** This scenario tests the operation of the receiver/repeater with a completely unmodified transmitter, e.g. the forward link performance of a modified terminal with totally unmodified infrastructure.
4. **Unmodified encoder (noise suppression off, RDA forced to full-rate) - modified decoder.** This scenario tests the operation of the reciever/repeater with a minimally modified transmitter, e.g. the reverse link performance of modified infrastructure with a terminal as described in (2), above.
5. **Modified encoder - Unmodified decoder.** This essentially demonstrates the benefits of disabling the long-term predictor on the encoder, even when used with unmodified decoders.
6. **Modified encoder - Modified decoder.** This tests the operation of the new method, i.e. embedding the Baudot character information in the unused delay bits.

Preliminary results for 0% FER and 2% FER are presented in tables 1 and 2. The results show that the encoder modifications by themselves are sufficient to reduce the CER to 0% for the clean channel condition, even when used with an unmodified EVRC decoder. When coupled with the decoder modifications, the CER remains 0% even for a 2% FER channel. Used only as a receiver/repeater, the proposed solution achieves a CER of 1% in clear channel (no change), but reduces the CER from 10% to 2.5% in a 2% FER channel. Results for cases (1) and (3) above are extremely level dependent – if the signal is sufficiently strong, noise suppression and the RDA have essentially no effect. However, if the signal has been attenuated prior to entering the encoder, performance will be significantly degraded by these modules for cases (1) and (3).

Table 1: CER Performance in 0% FER Channel

	Encoder		
Decoder	**Unmodified**	**Unmodified (ns off, rate = full)**	**Modified**
Unmodified	1% - ? (see text)	1%	0%
Modified	1% - ? (see text)	1%	0%

Table 2: CER Performance in 2% FER Channel

	Encoder		
Decoder	**Unmodified**	**Unmodified (ns off, rate = full)**	**Modified**
Unmodified	10% - ? (see text)	10%	8.5%
Modified	2.5% -? (see text)	2.5%	0%

CONCLUSION

A totally passive, receiver-only solution for transmitting TTY/TDD signals in-band through the EVRC as presented in the original PCC contribution would be performance limited by the timing jitter introduced by the EVRC's long-term predictor and by the frame erasure handling algorithms specified in the IS-127 standard. An improved solution has been presented that can provide essentially error-free performance in channel conditions much worse than 2%. The proposal also includes the original PCC proposal because (1) it provides an extra level of insurance against the case where the modified terminal must operate with unmodified infrastructure or visa-versa, and (2) many of the operations required to implement the receiver/repeater in the decoder (as proposed) are also required to implement the new solution, so the incremental overhead to implement both is very low.